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ABSTRACT

A study was conducted to determine if covert reader-generation of interspersed prequestions would affect recall of science-oriented prose. Sixty college freshmen in a basic skills reading course were divided into three groups: Group I received 5 hours of training and practive in the construction of self-generated questions, including recognition of topic sentences, paragraph organization, and differentiation of various question types; Group II was given, in 1 hour, a condensed version of the same training; and Group III, the control group, received alternative training. Subjects read science passages written at the 9th and 16th grade levels and completed multiple choice and competition criterion tests immediately and 1 week later. Results showed that (1) there was no overall effect for treatment; (2) treatment groups scored higher on the difficult passage and lower on the easier passage than did the control group, with Group I the highest and lowest respectively; (3) a strong trend was indicated for the treatment groups to score higher on delayed and lower on immediate recall measures; (4) there were no significant differences between training groups; and (5) no between-group differences resulted from the two types of criterion posttests. (Author/FL)

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THE RELATIONSHIP OF TRAINING IN SELF-GENERATED QUESTIONING WITH PASSAGE DIFFICULTY AND IMMEDIATE AND DELAYED RETENTION

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ABSTRACT

The present study was designed to determine whether covert reader-generation of interspersed prequestions affects recall of science-oriented prose. Sixty college freshmen in a basic skills reading course were divided into three groups: Group I received five hours of training and practice, Group II received one hour, and Control Group III received alternate instruction. Evaluative testing included science passages at the ninth and sixteenth grade levels, followed immediately and one week later by multiple choice and completion criterion tests. 1. There was no overall effect for treatment. 2. Treatment groups scored higher on the difficult passage and lower on the easier passage than the control, with Group I highest and lowest respectively. 3. A strong ($p<.06$) trend was indicated for the treatment groups to score higher on delayed and lower on immediate measures. 4. No significant differences were found between the two training groups. 5. No between-group differences resulted from the two types of criterion posttests.

Adjunct questions have long been recognized as being facilitative in improving comprehension and retention (Washbourne, 1929; Holmes, 1931). While the effects of experimenter-provided questions have received a great deal of attention from researchers (Rothkopf, 1966; Frase, 1967; Anderson & Biddle, 1975), the use of reader-generated questions has intrigued study skills researchers as being more valuable in many reading situations (Robinson, 1961; Singer, 1978; Singer & Donlan, 1982).

Wittrock (1974) posed a "generative model of learning" which suggested that when the learner generates his own study aids, the integration of new information with previously existing knowledge is enhanced (Doctorow, Wittrock, and Marks, 1978; Mayer, 1980). Generation of learning aids allows for greater semantic analysis (Craik & Lockhart, 1972) in which the learner can recognize patterns and relationships among ideas and extract meaning in a more comprehensive fashion.

In general, attempts to demonstrate the effectiveness of reader-generated questions have been disappointing (Morse, 1975; Schmelzer, 1975). A well-known study by Frase and Schwartz (1975) did find improved retention, but subjects worked in pairs to question each other, rather than constructing their own questions.

More recent studies, in which subjects have received prior training and practice in question generation, to develop fluency in the procedure and to improve quality of questions, have indicated that the procedure can be effective under certain circumstances. Andre and Anderson (1978-1979) found that low ability subjects benefit from use of self-questioning. Singer and Donlan (1982) carried out a training program in which treatment

subjects learned to generate questions appropriate to the highly conventionalized structure of narrative text. Findings indicated that the treatment group's retention scores improved after several training sessions.

The present study was designed to partial out several factors implicated but not explored in past studies of reader-generated adjunct questioning. The variable of primary interest was that of reader-generated questioning itself, the between - subjects factor employed as a grouping variable. A second variable was that of length of training. Two treatment groups were administered five hours (Group I) and one hour (Group II) of training and practice.

A third issue was that of immediate versus delayed recall. Researchers have often left this variable unexplored, despite the obvious value of delayed recall in the study of learning strategies. It was hypothesized in the present study that the processing engendered by questioning would be particularly conducive to delayed memory (Craik & Lockhart, 1972; Berlyne, 1954).

A fourth factor, that of availability (completion "fill-in" criterion tests) versus accessibility (multiple choice criterion tests) of information, was included. The fifth factor, difficulty of reading material, was held to be important, as previous research had suggested that adjunct aids are of particular value when text is difficult for students to process (Andre & Anderson, 1978-1979).

The problem of retaining prose material is of special importance to underprepared college students, and therefore a

basic skills college population was selected for the present study.

In addition, this study improves upon prior research in that the actual type of questions used were interspersed, covert modified prequestions, similar to those suggested by Robinson (1961). That is, questions were developed internally, one per paragraph, based upon the lead sentence of the paragraph, which is usually a topic sentence in expository text. In informal pilot studies, interspersed prequestions proved to be time-effective and especially productive in terms of setting purpose for reading.

Method

Subjects

Subjects were drawn from a freshman basic skills reading program, having been placed in the program on the basis of scores below 162 on the reading comprehension subtest of the New Jersey College Basic Skills Placement Test, or below 300 on the verbal section of the Scholastic Aptitude Test. Mean raw score on the Nelson-Denny Reading Test, Form D, comprehension subtest, was 32.95, which represents the 25th percentile. Mean raw score for Group I was 34.00, Group II was 31.59, and Group III was 33.33. Students were for the most part members of minority groups. After random assignment to one of the three conditions, training took place during normal class time in separate classrooms for each group.

Training

Treatment Group I (Extended Training) was given five hours of training and practice in construction of self-generated questions. Training included recognition of topic sentences, paragraph organization, and differentiation of various question types as appropriate to paragraph content and structure. Treatment Group II (Brief Training) was given a condensed version of the same training. Group III, the control group, received alternate training.

The training program, devised in the form of self-correcting workbooks to control for the teacher factor, was purposely designed to be as standard and generalizable as possible so that results could be attributed to the questioning itself rather than to an innovative technique or to a particular algorithm for question construction. Subjects were asked to identify the topic and organization of each paragraph in a reading selection from its first sentence. Varied expository structures were examined, such as main idea/supporting details, cause and effect, process, and definitional. Subjects then constructed questions appropriate to the particular structure and read to find information relating to the question. They carried out this same procedure with each paragraph in the reading selection, and also attempted to identify inter-paragraph relationships to use as bases for question construction.

During the three training sessions, Group III and Group II (except when itself undergoing questioning training) were assigned alternate workbook-like readings involving recognition of

expository organizational structures frequently occurring in the content areas. Assignments were judged to be of equal length and difficulty to the assignments used in the training sessions.

Testing

Two passages were administered in random order during the final criterion posttesting, with similar textbook-like content from the sciences and similar structural organizations. The easy passage was rated at the ninth grade level (Fry readability graph) and entitled "Discovery by Accident." The passage was 804 words long. The difficult passage, "The Use of Oceanography," was 817 words long and rated at the sixteenth grade level. Every paragraph in both selections began with a topic sentence.

Subjects in the treatment groups were instructed to use covert self-questioning techniques, while the control group simply read. All groups were instructed to use the entire eleven minutes allotted, rereading or studying if they finished early.

In order to insure that treatment subjects followed instructions to construct questions, a third passage was administered to all subjects without informing them prior to or during reading that it was in any way different from the two test passages. Instead of being followed by test questions, this passage was followed by a request that the treatment subjects recall and write the questions they constructed. Subjects were informed at the beginning of the test session that one or more of these exercises existed in each test package. Results indicated that questions constructed did deal with relevant aspects of the

topic sentences, a factor which made post hoc construction of accurate questions highly unlikely. No subject was dropped from the study on the basis of this passage.

Two tests of immediate retention were administered for each passage. Questions were of the lower-level, detail type. Reliability was computed as .80 for both fill-in tests, .85 for the easy multiple choice test, and .87 for the difficult multiple choice test. The same tests were administered one week later, to check longer term retention.

Results

The one between-subjects grouping factor consisted of three levels, extended training, brief training, and control. There were three within-subjects crossed factors of two levels each: Time (immediate and delayed), difficulty (easy and difficult), and type of test (completion and multiple choice). Levels of difficulty and type of test were randomized within time for test administration. Data was analyzed using an analysis of variance with repeated measures on the within-subjects factors.

Composite and group scores are presented in Table 1. No main effects were found for treatment. Main effects, to be expected and of limited interest, were found for time, difficulty, and type of test.

The key finding for the study was a treatment by difficulty interaction, with an F value of 3.28 (2,57; $p<.05$). Group I performed better on the more difficult passage than did the Group III control, while the opposite was true for the easier

passage, a result significant at the .01 level according to Scheffe post hoc comparisons. Group II's results were intermediate in both cases, and not significantly different from either Group I or III.

Analysis also suggested that the treatment may have had some effect when testing was delayed. In the analysis of the treatment by time relationships, the F value produced was 3.05 (2,57), yielding a two-tailed probability of .0554. Groups I and II scored very close to one another, while Group III did somewhat better than the two treatment groups on the immediate tests and worse on the delayed tests.

Discussion

Of the seven possible interactions involving the treatment factor, only one was significant, difficulty by group. In addition, the apparent relationship between treatment and time of criterion posttest merits discussion.

The group by difficulty of passage interaction corresponds neatly to prior findings that poorer readers are more facilitated by the use of adjunct questions than better readers (Mayer, 1975; Andre & Anderson, 1978-1979). The present study, taking a different approach, compared passages of different difficulty levels with the same readers. For the easier passage, the control group actually scored better than Group I. For the difficult passage, the reverse was true. Apparently the self-generated questioning procedure is beneficial when carried out with

challenging material, but can prove deleterious if used with easier material.

These results suggest that question generation may be helpful when text is so complex as to warrant extra analysis, but it may hinder retention when the text is simple to understand. In the difficult passage, the questioning may have provided the basis upon which the requisite integrative and associative semantic elaborations were performed (Mayer, 1980). Retention of the simpler passage, sufficiently analyzable without special elaborative techniques, actually declined when automatic comprehension processes were disrupted by the strategy. Metacognitive abilities of the readers were sufficiently mature to provide fluency, and the questioning strategy apparently impeded the automaticity to be expected when mature readers encounter fairly simple material.

Results of the treatment by time relationship, while not found to be significant at the .05 level, warrant discussion here and further investigation in the future.

The results support the contention that self-generated questioning techniques may be most effective only under certain specific conditions. In no immediate test did the two treatment groups show clear superiority over the control. Indeed, on the average, the control group scored better than the treatment groups on the immediate tests. It is quite possible, then that the self-generated questions actually impeded immediate retention.

[On the delayed measures, however, the treatment groups scored higher than the control, though not to .05 significance. It seems that questioning may be of value for delayed recall,

especially for material which is difficult or challenging in nature. If this conclusion can be verified by further research, it would fit comfortably into Craik and Lockhart's (1972) "levels of processing" model, which suggested that cognitively lower level processing leads to better short-term retention and worse long-term retention. Processing of a wider, more semantically elaborative nature leads to better long-term and decreased short-term retention. The key purpose of generative learning is to provide for increased semantic analysis of information, the activation of relevant schemata, and the opportunity to bring these knowledge structures to bear on the problem under consideration (Wittrock, 1974; Anderson & Glover, 1981).

No qualitative differences were noted in results on the multiple choice and completion tests. While questions constructed by subjects were generally of a higher level, oriented toward text organization, the criterion questions on the tests were uniformly low-level detail types. Future research might benefit from alternate forms of criterion measures, such as free recall protocols or structural hierarchy diagrams.

The present study did not find any significant differences due to amount of training, though on each of the four criterion tests which did show results in favor of either Group I or III, the Brief Training Group II scored at some intermediate level between the two. On the two delayed tests which demonstrated Group I superiority, Group II's score was only 2.3% lower than that of Group I. Apparently once a student has received a short lesson in self-questioning and some practice, there are diminishing returns for additional instruction and practice.

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